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(54) **SUPPORTING FRAMEWORK HAVING CONNECTION NODES**

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E04H 1/12 (2006.01)
E04B 1/19 (2006.01)
E04B 1/24 (2006.01)
E04B 1/343 (2006.01)

(52) **U.S. Cl.**

CPC ***E04B 1/1903*** (2013.01); ***E04B 1/1906*** (2013.01); ***E04B 1/24*** (2013.01); ***E04B 1/2403*** (2013.01); ***E04B 1/343*** (2013.01); ***E04B 1/34326*** (2013.01); *E04B 1/1912* (2013.01); *E04B 2001/1927* (2013.01); *E04B 2001/1957* (2013.01); *E04B 2001/2406* (2013.01); *E04B 2001/2481* (2013.01); *E04B 2001/2496* (2013.01)

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CPC ... E04B 1/1903; E04B 1/2403; E04B 1/1906; E04B 1/34326; E04B 1/34331; E04B 1/343; E04B 2001/2406; E04B 2001/1957; E04B 2001/1927; E04B 2001/2481; E04B 1/24; E04B 2001/2496; E04B 1/585; E04B 2001/1969; E04B 2001/196; A47B 47/0008; A47B 7/0016; Y10T 403/342; Y10T 403/343; Y10T 403/347; F16B 7/00; F16B 9/02

See application file for complete search history.

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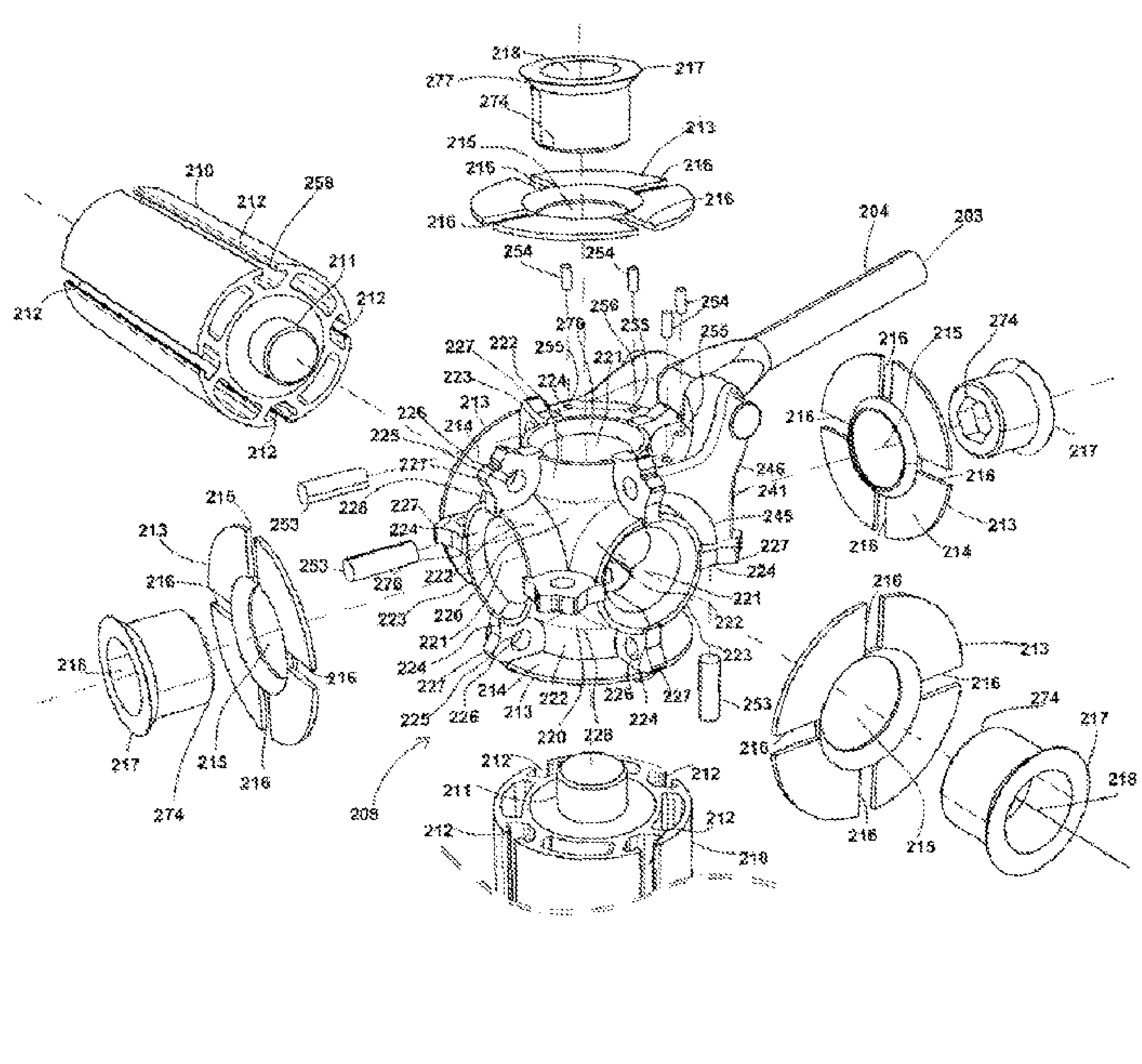
(57) **ABSTRACT**

The invention is about a supporting framework, having nodes and at least one framework component. The framework components are either panels or diagonal braces or a combination of them. At least one node has a connector and at least one bar. At least one connector has a plurality of bar receiving members that are located in a corresponding plurality of faces of an imaginary polyhedron and at least one bar has a first end, fixed to the one of the bar receiving members of the connector of a first node and a second end, fixed to the corresponding bar receiving member of the connector of another node.

14 Claims, 10 Drawing Sheets



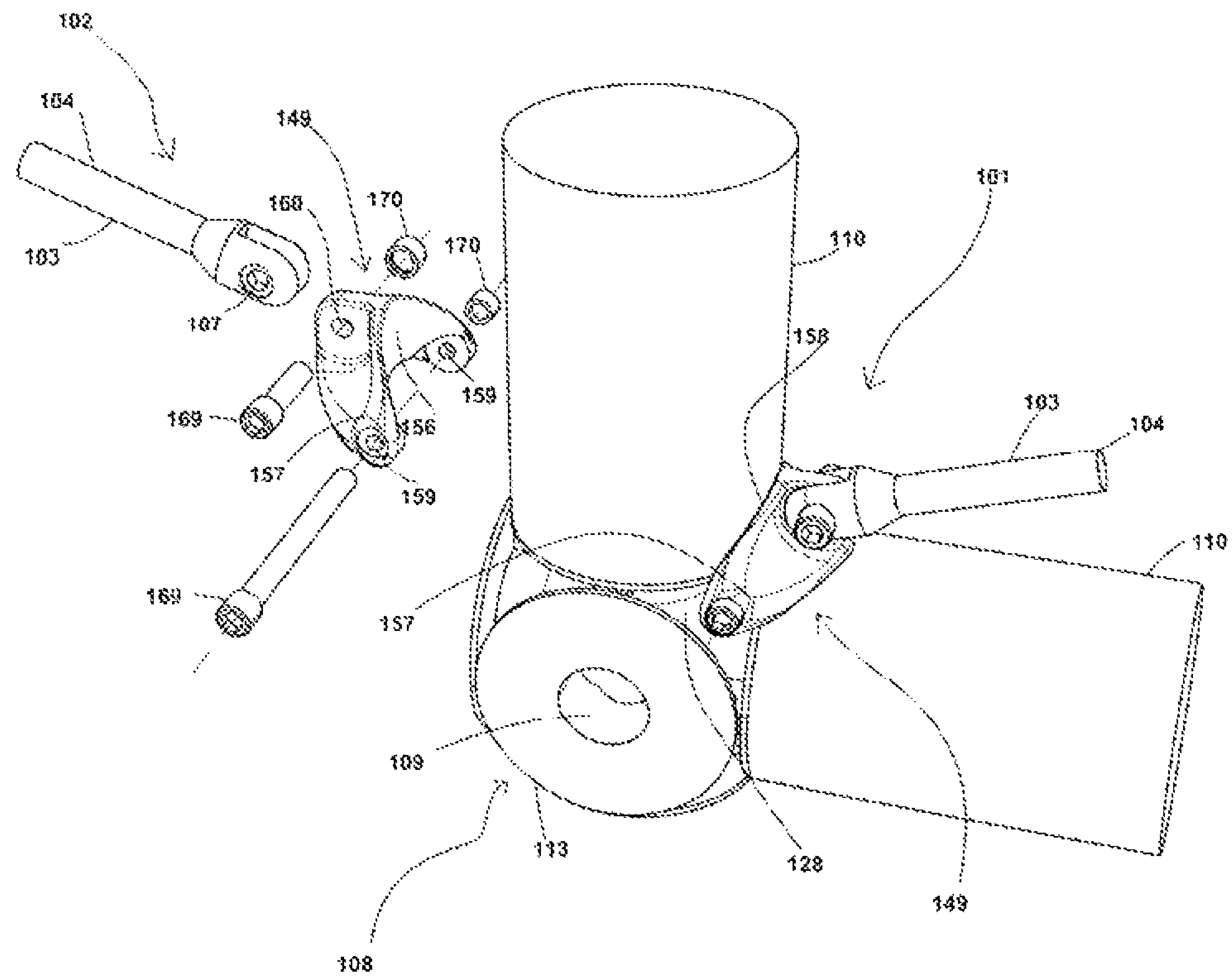

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Figure 1

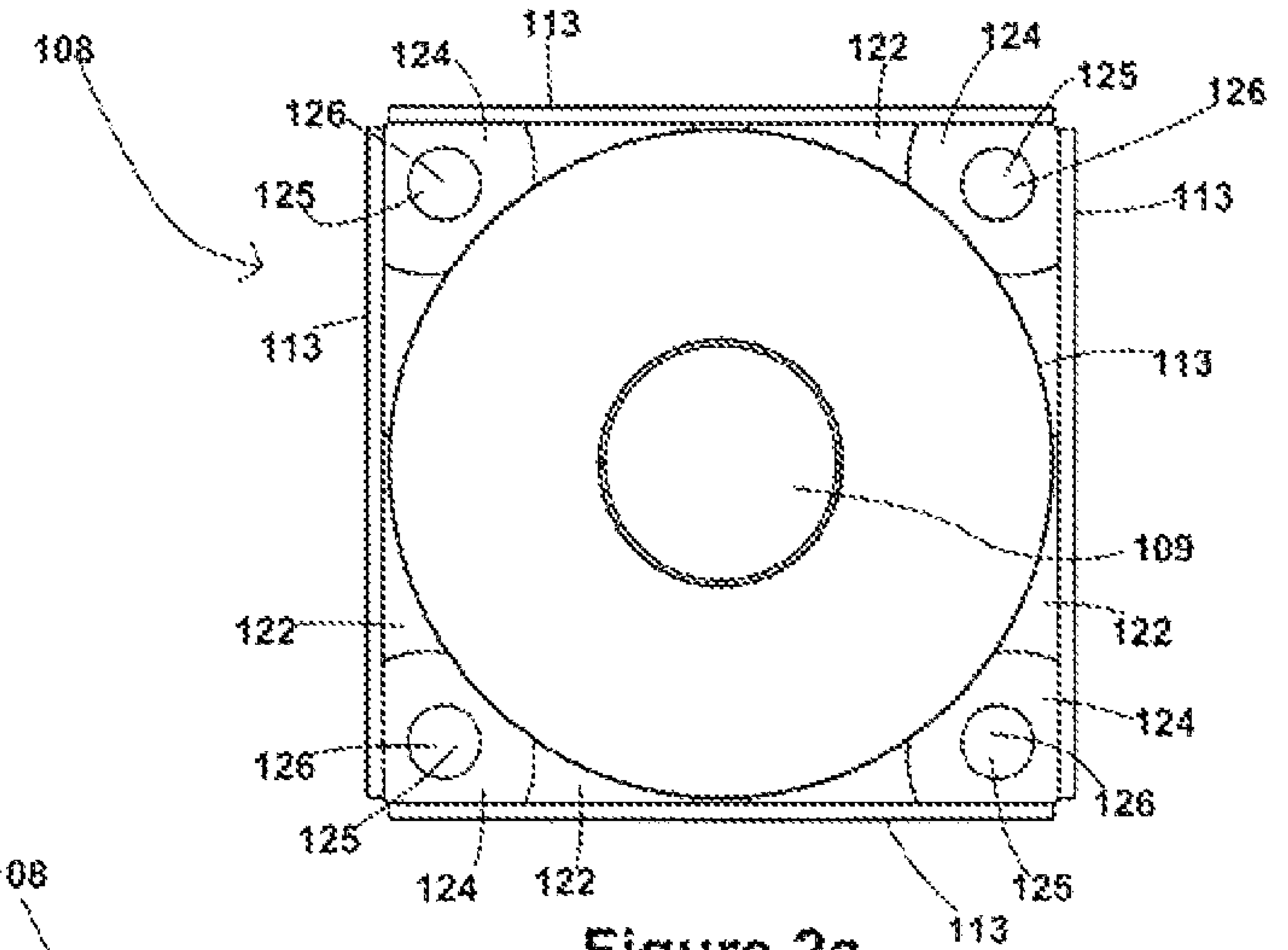
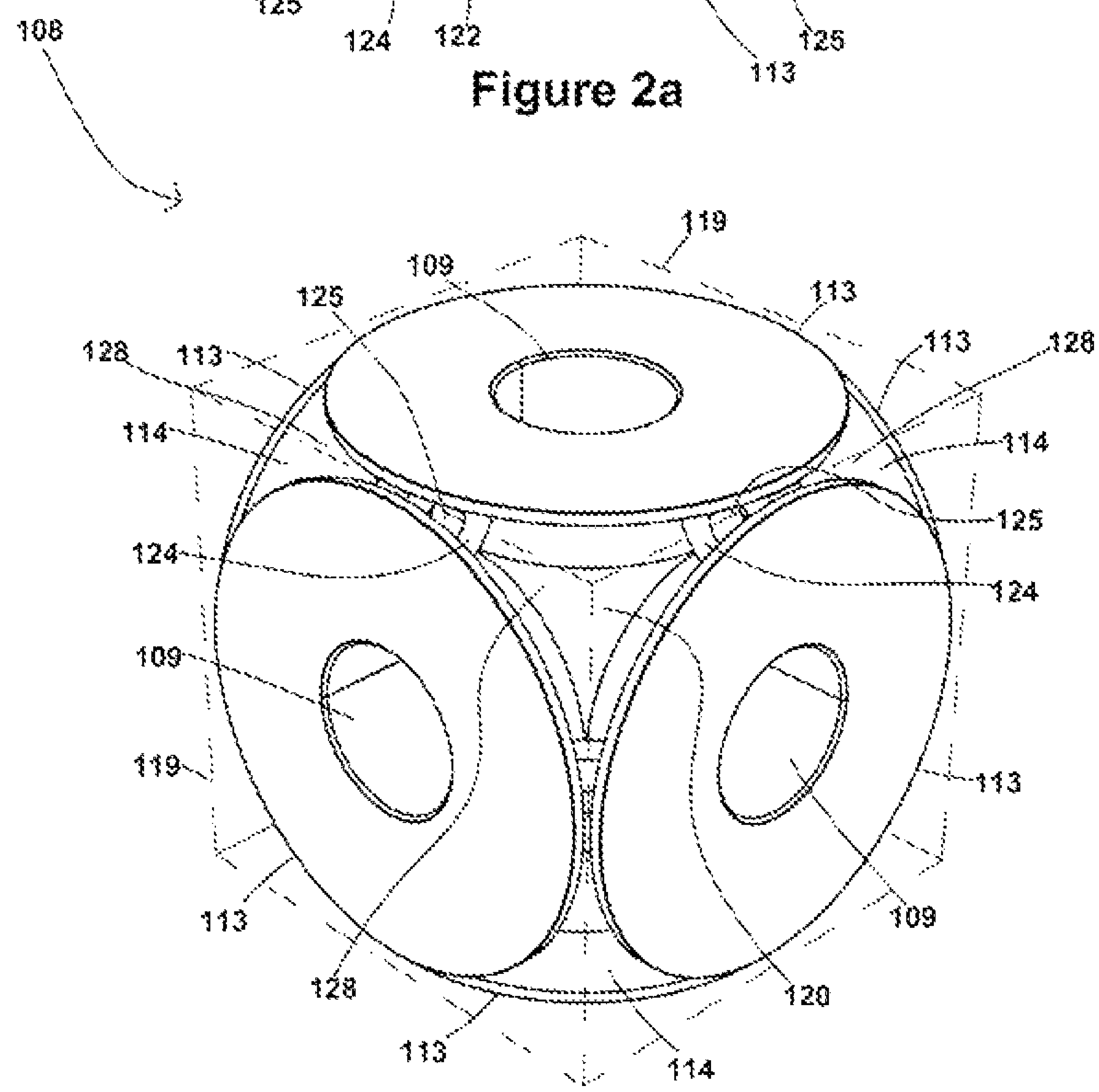


Figure 2a



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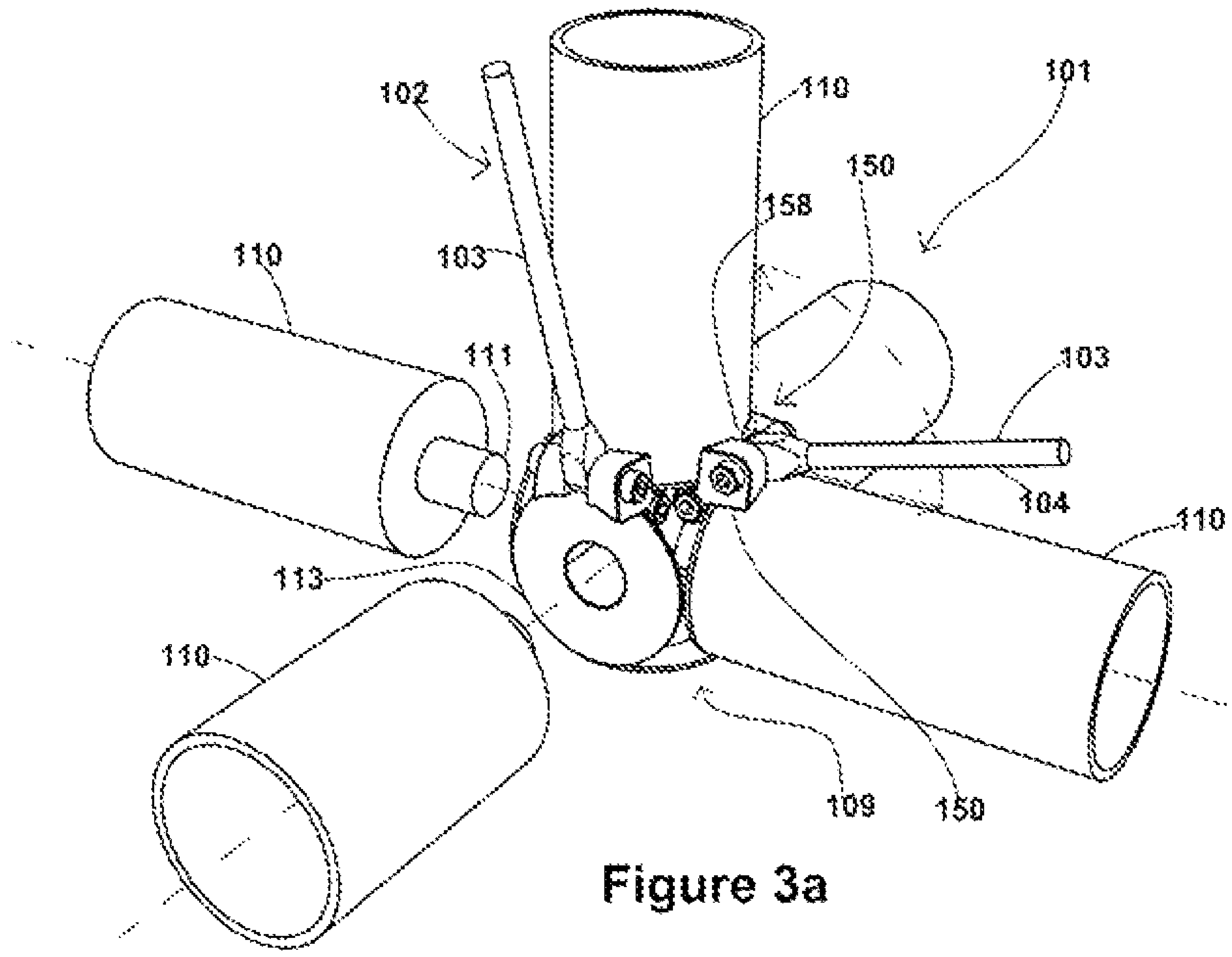


Figure 3a

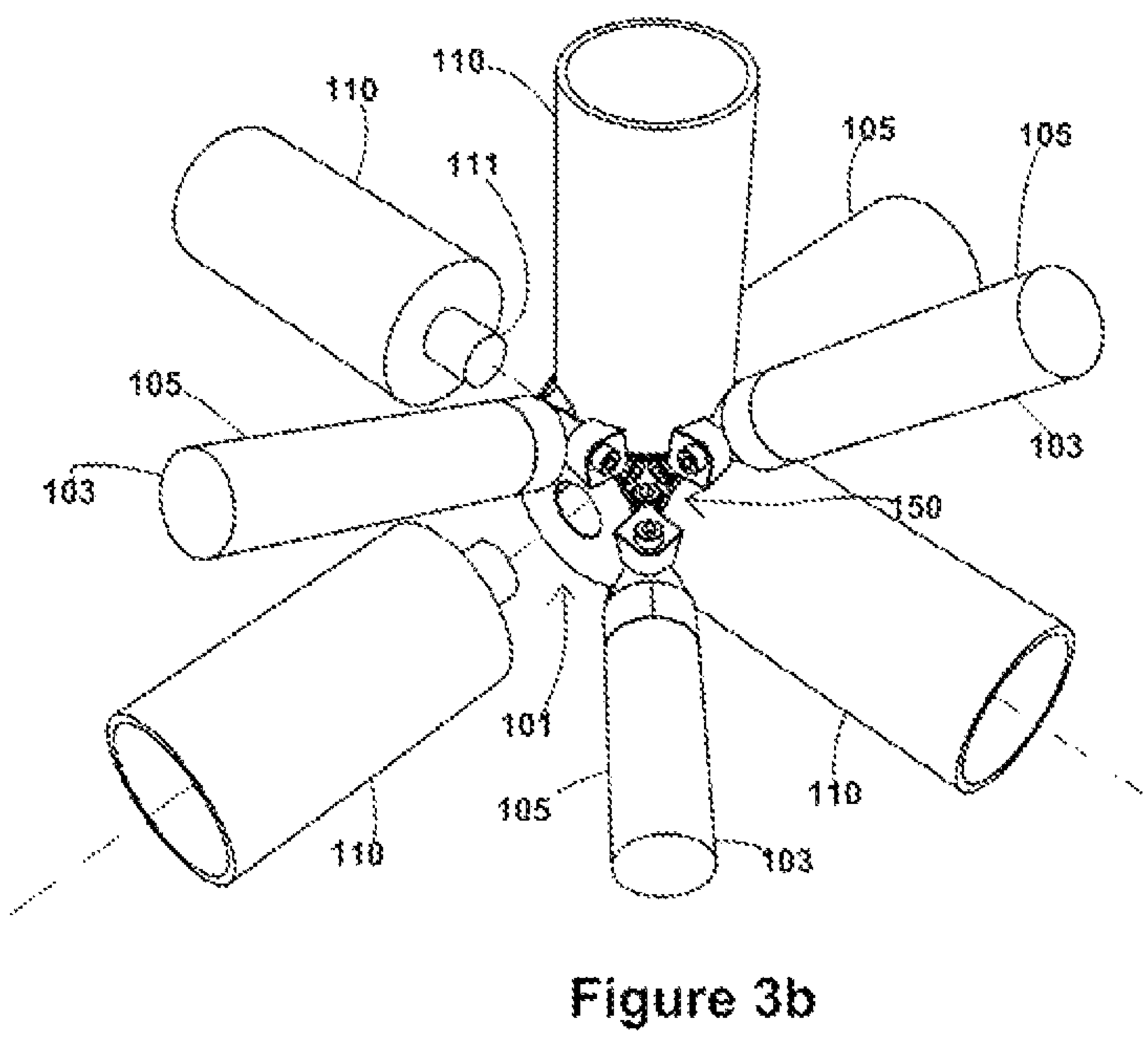
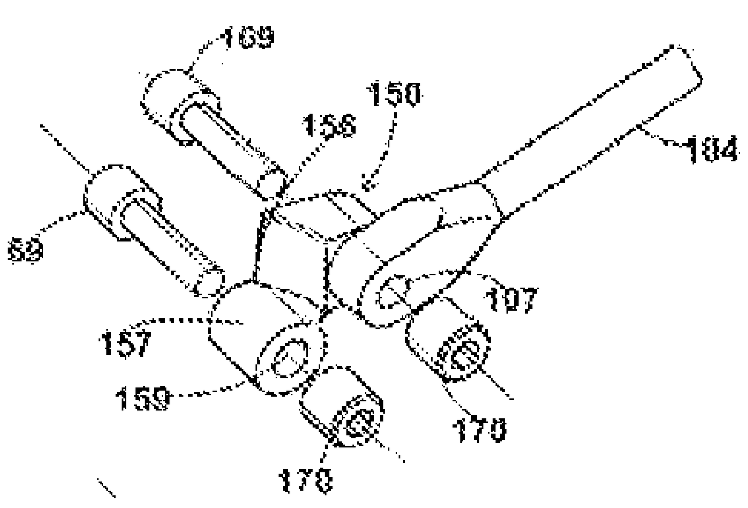


Figure 3b

Figure 4d



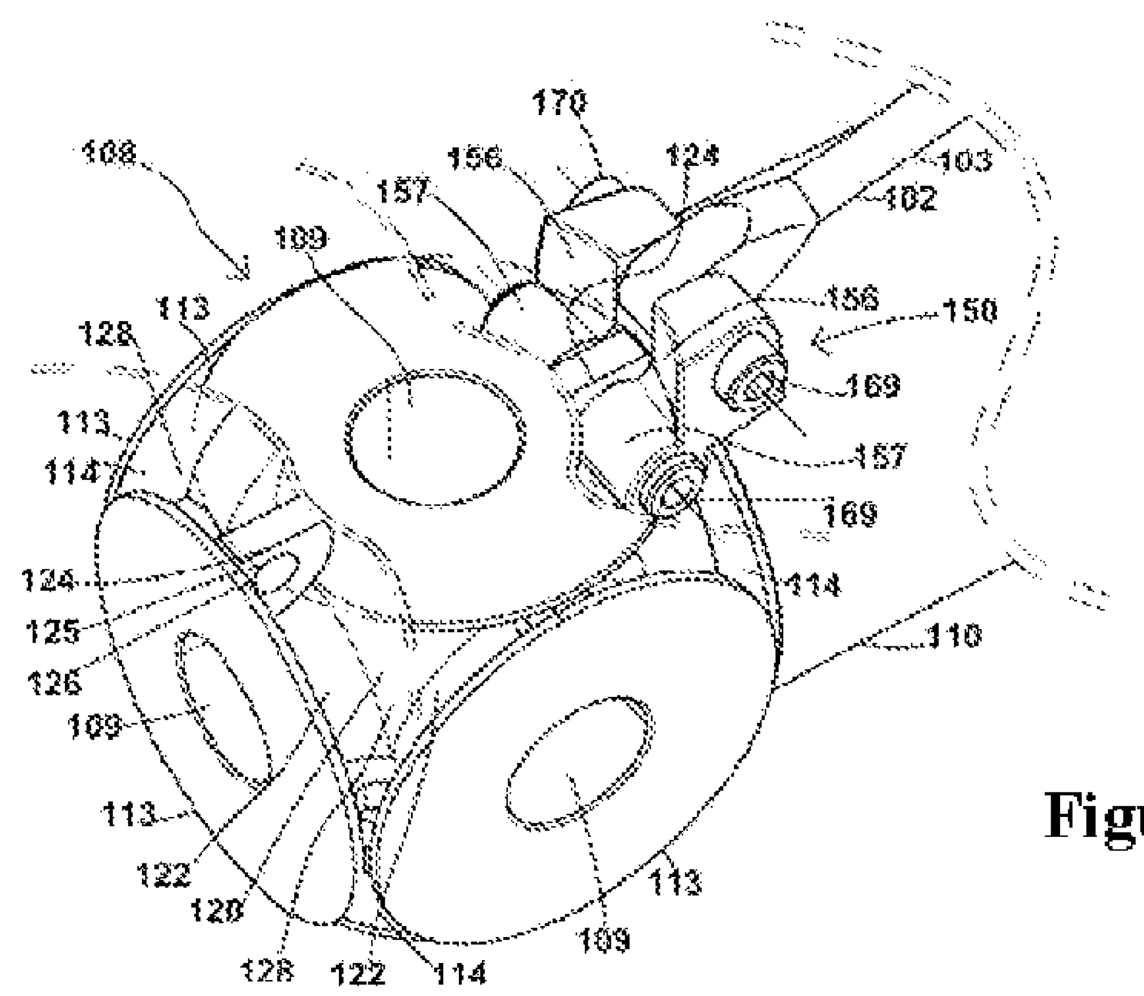
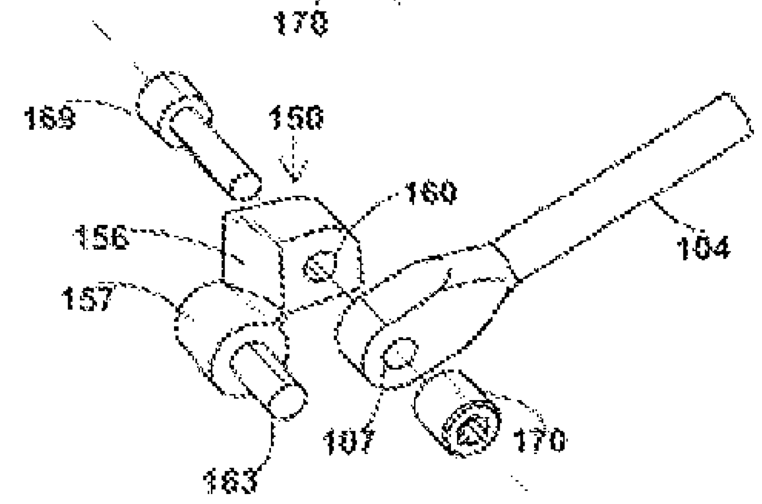
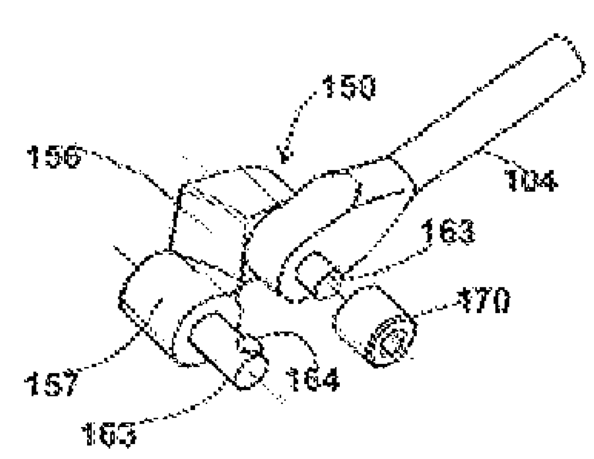
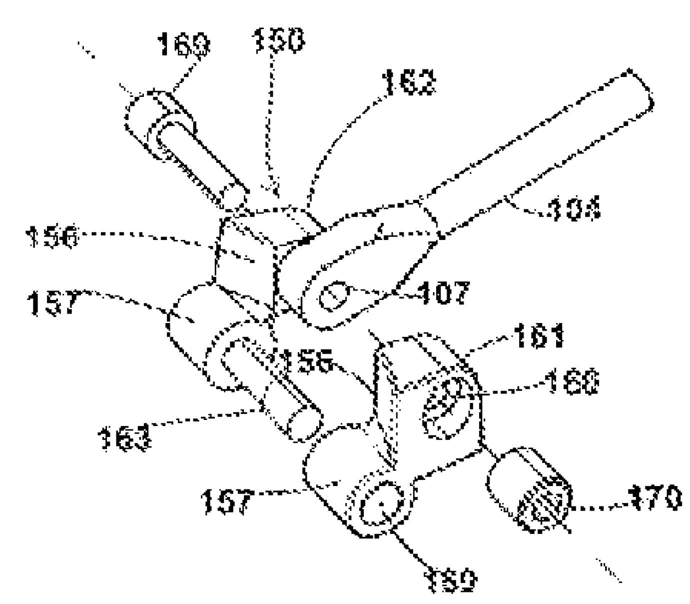


Figure 4a

Figure 4e







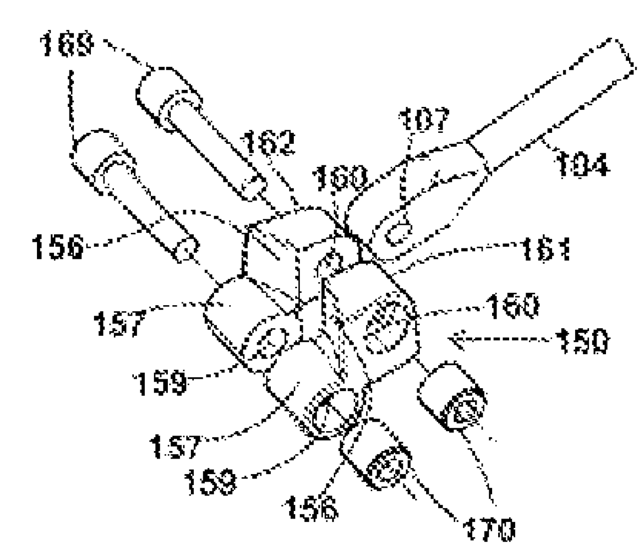
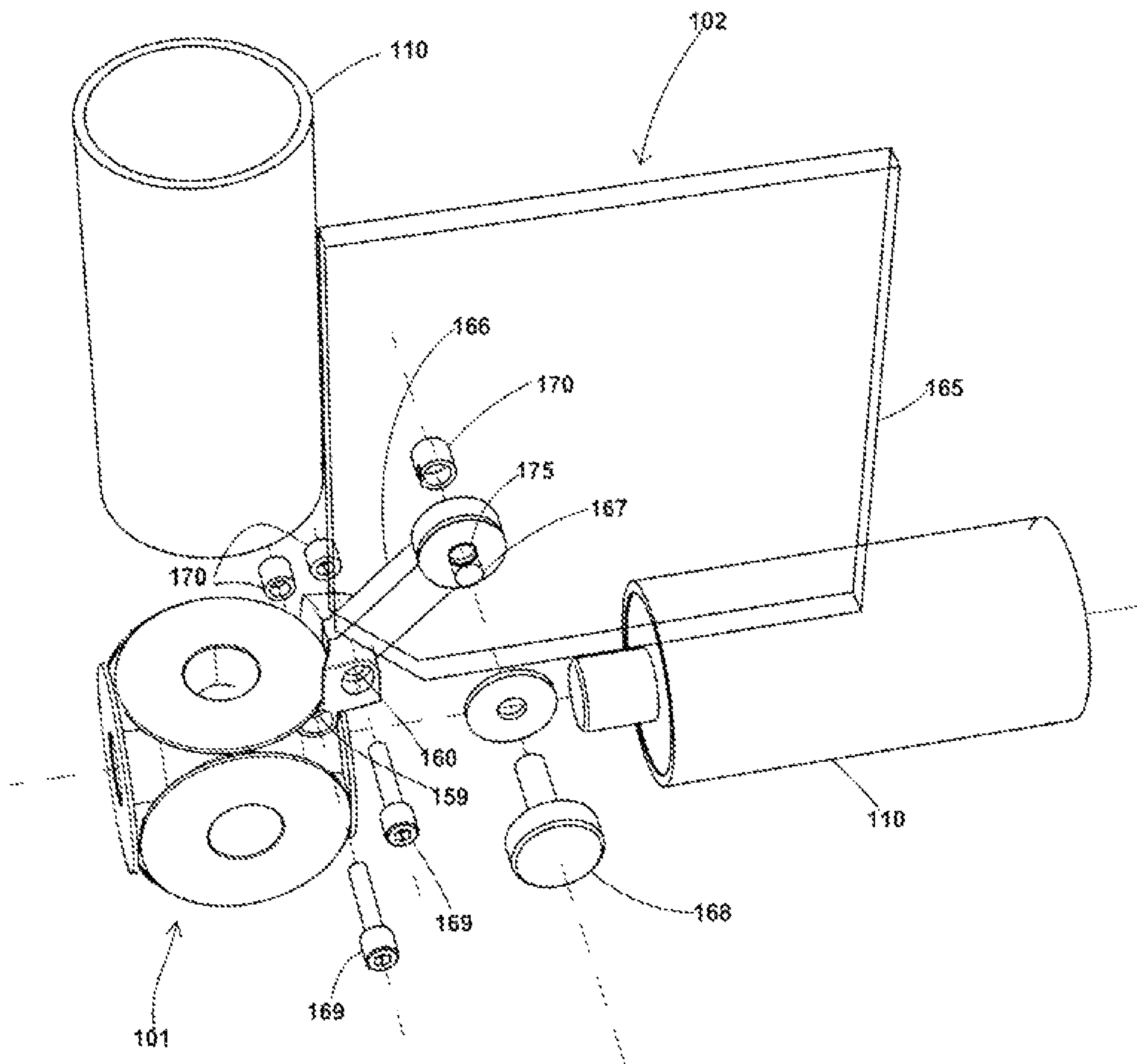


Figure 4f

Figure 4c

Figure 4b



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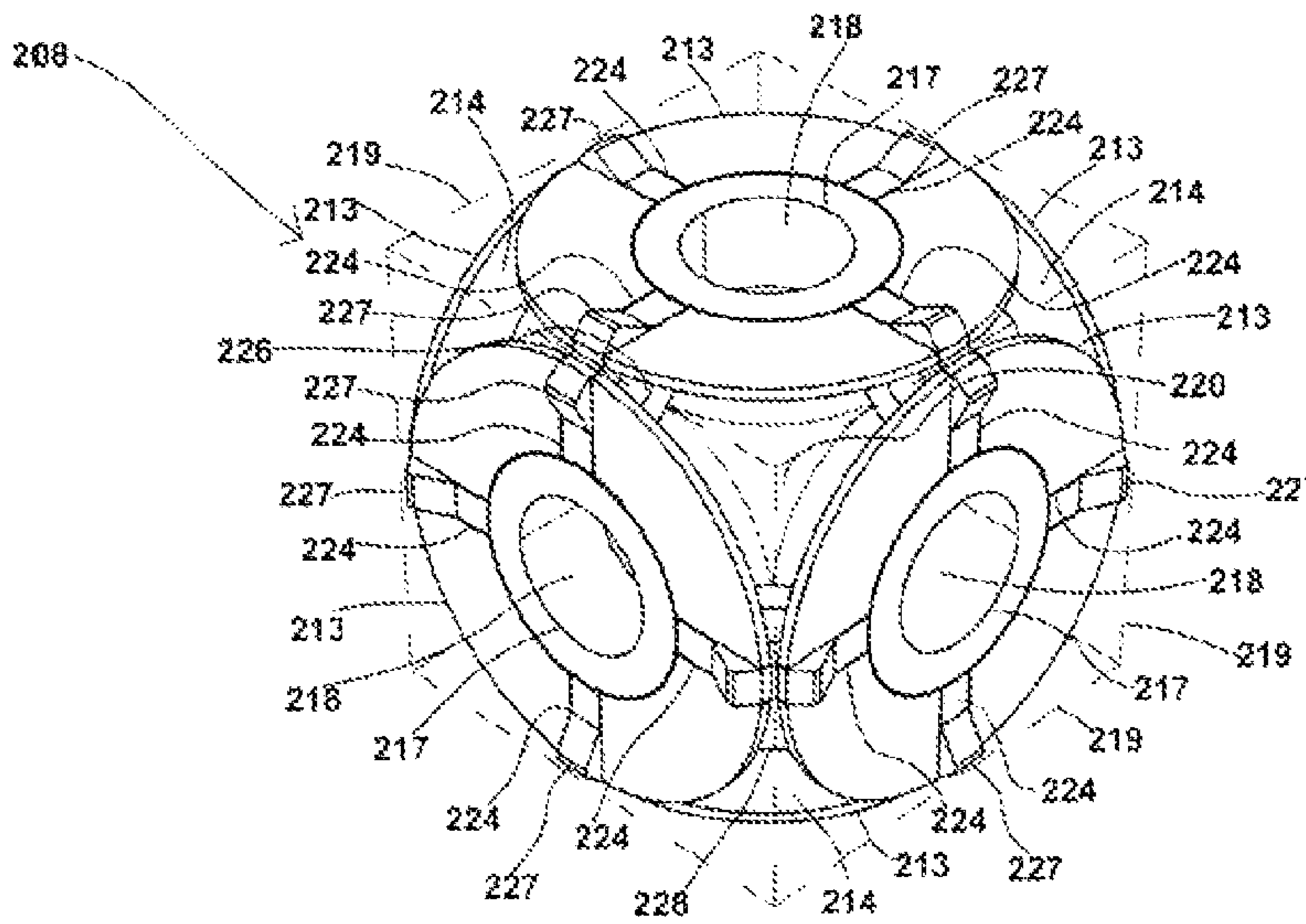
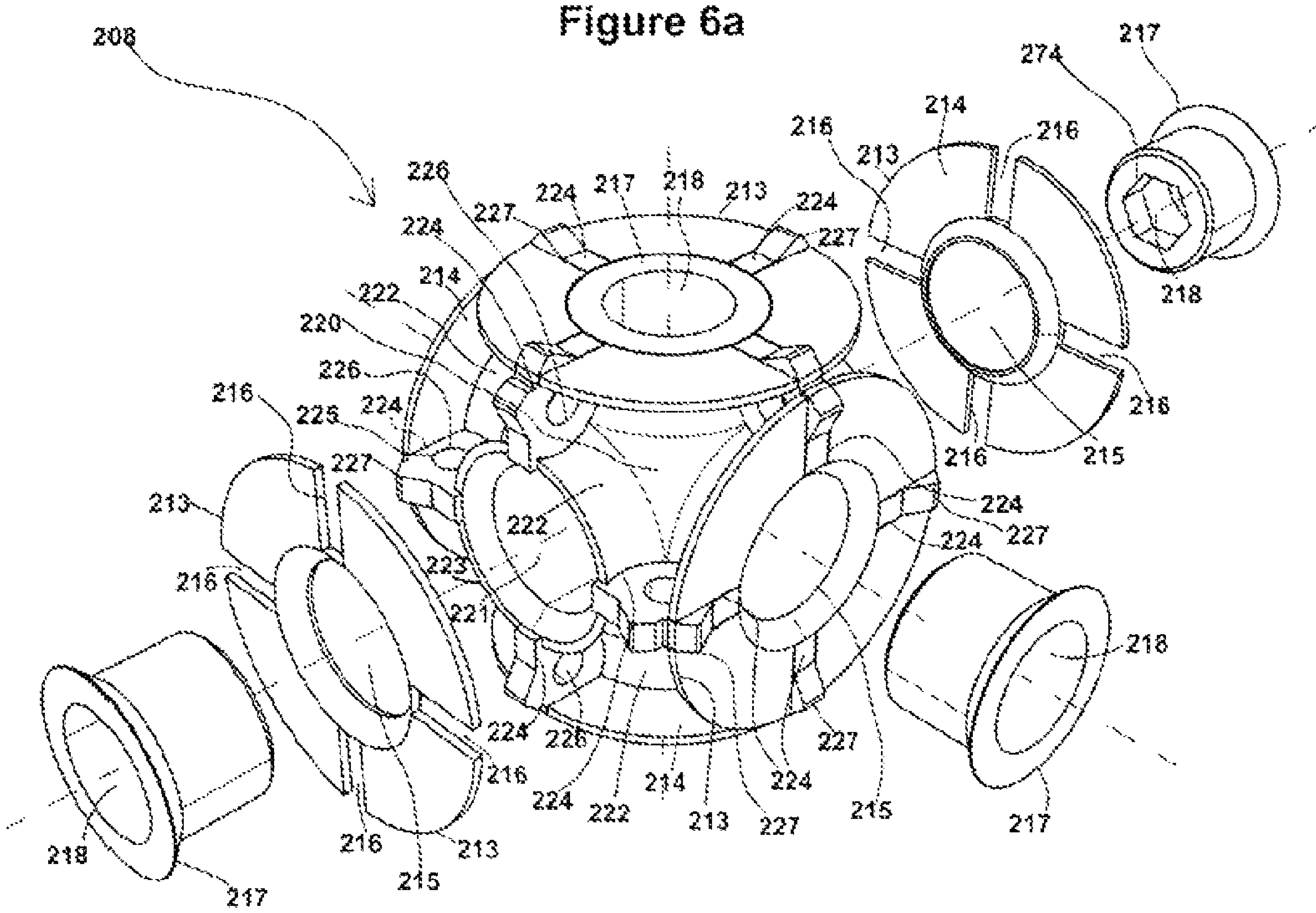


Figure 6a



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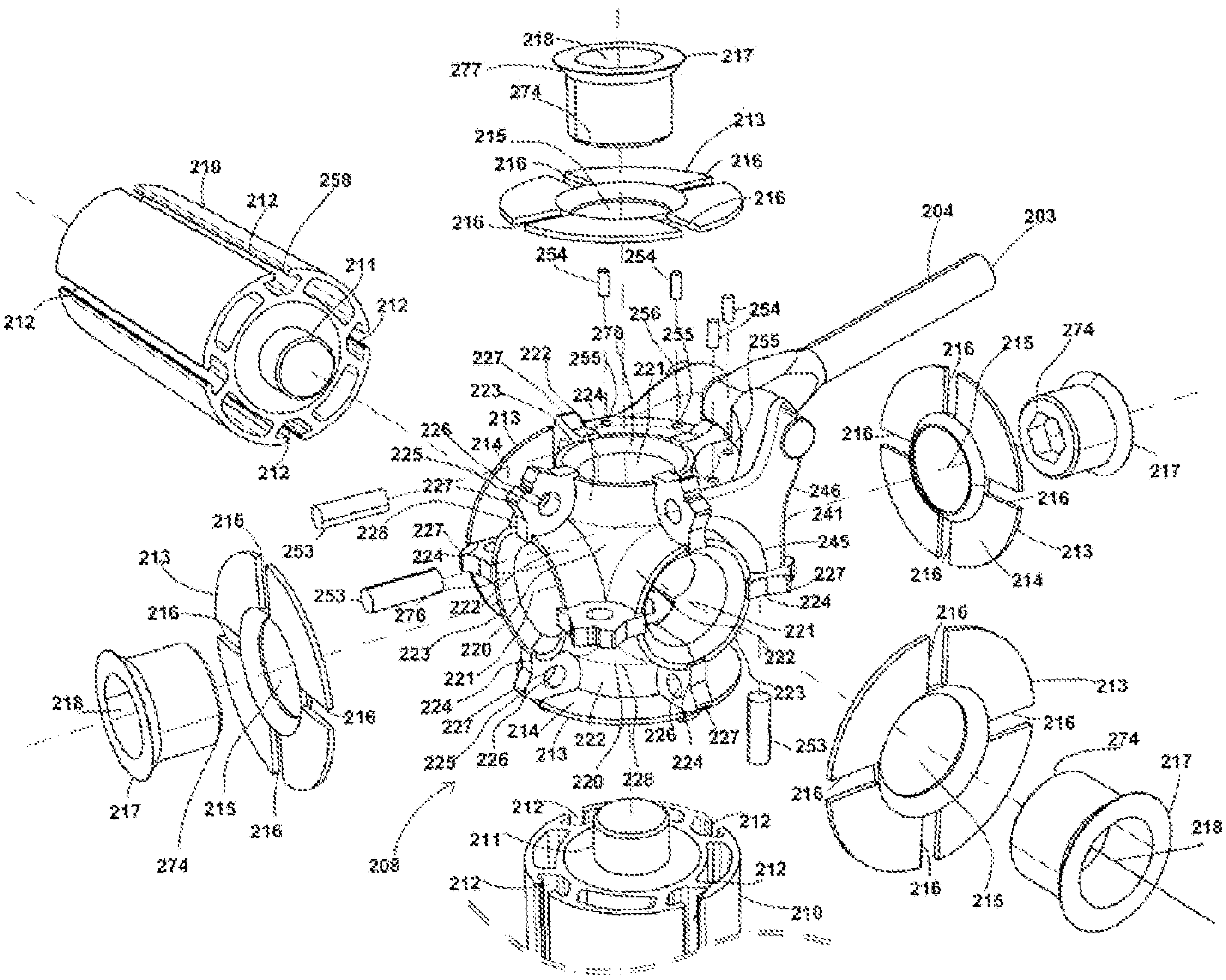
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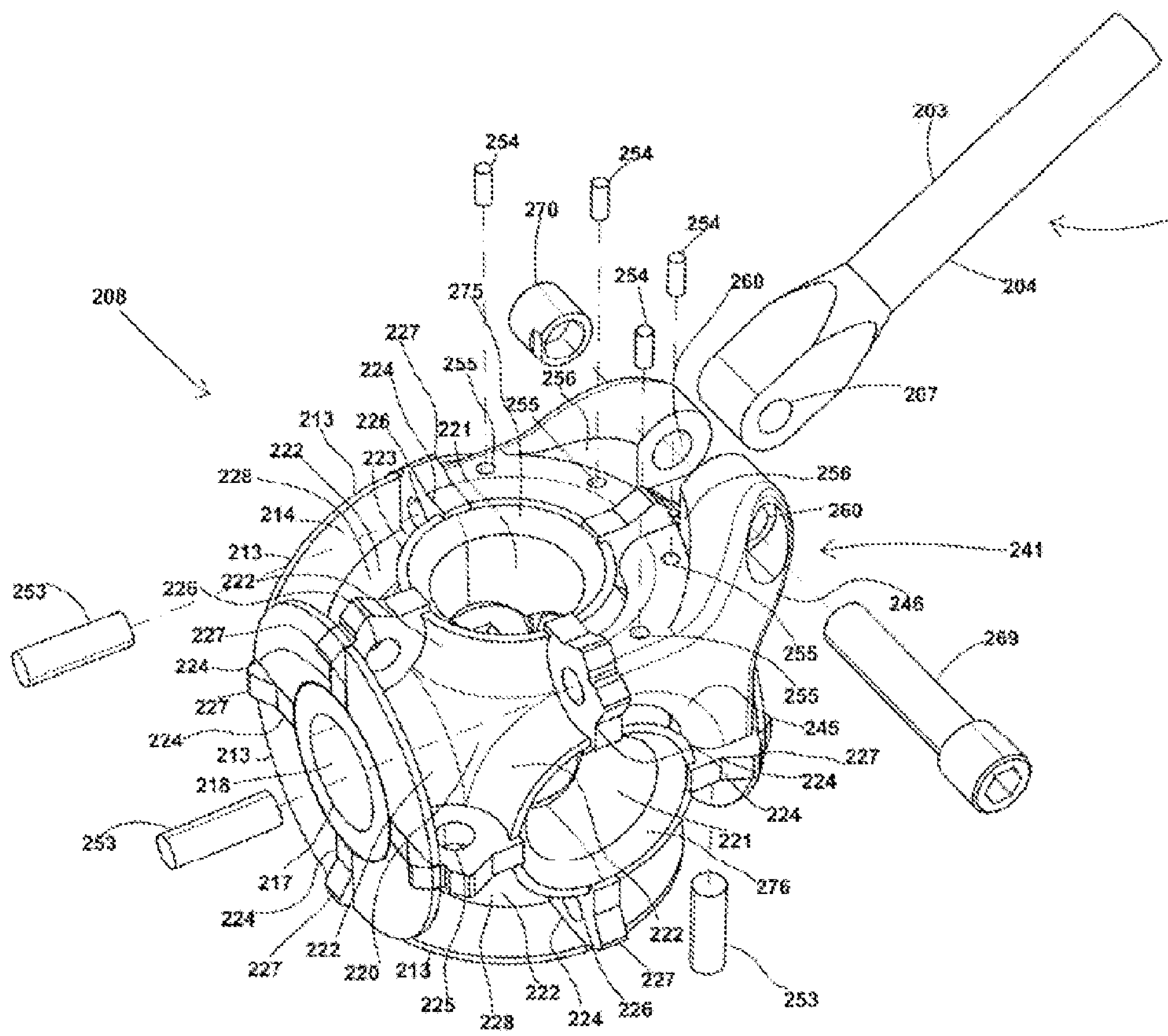
Figure 7



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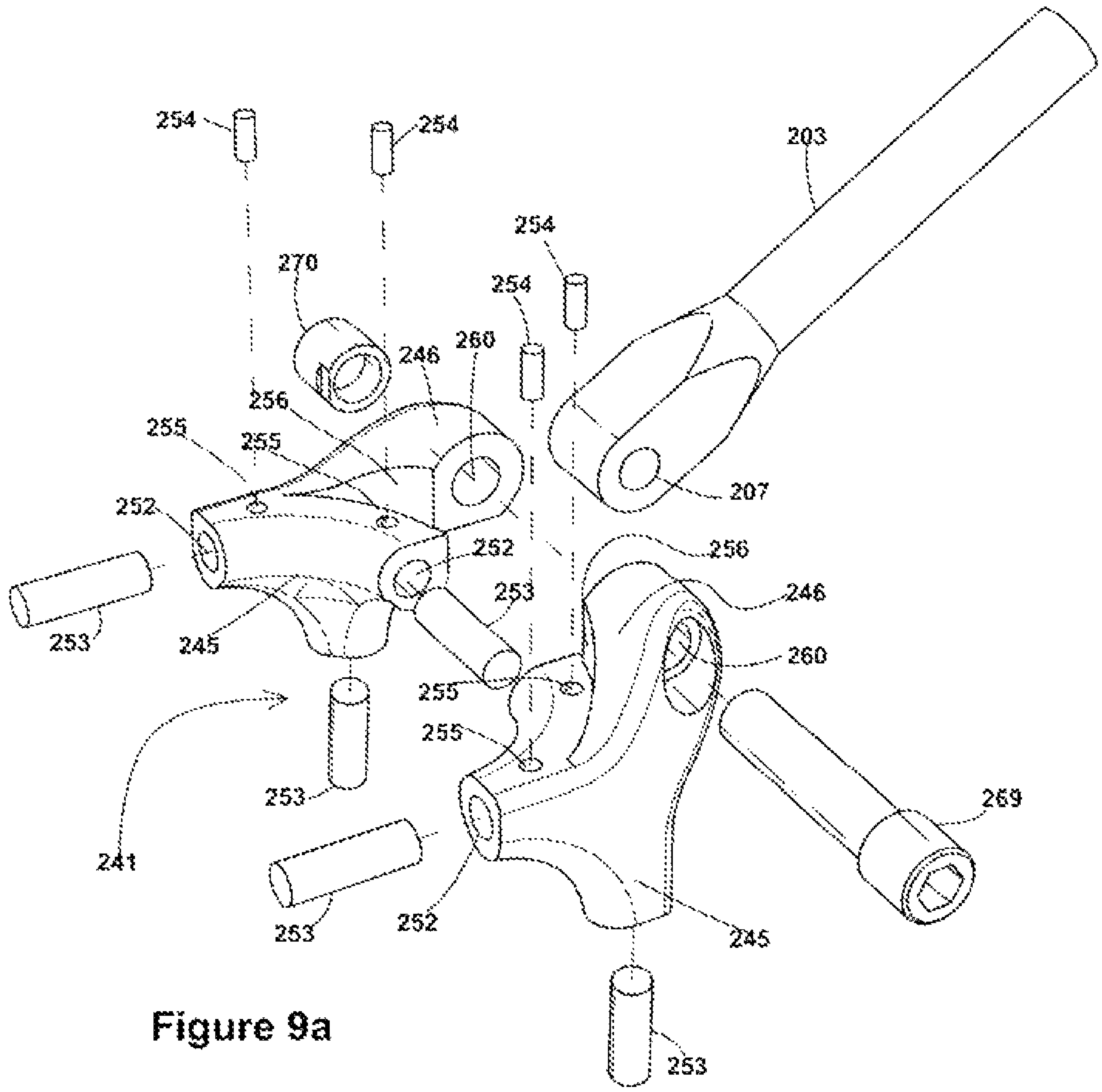

Figure 9a

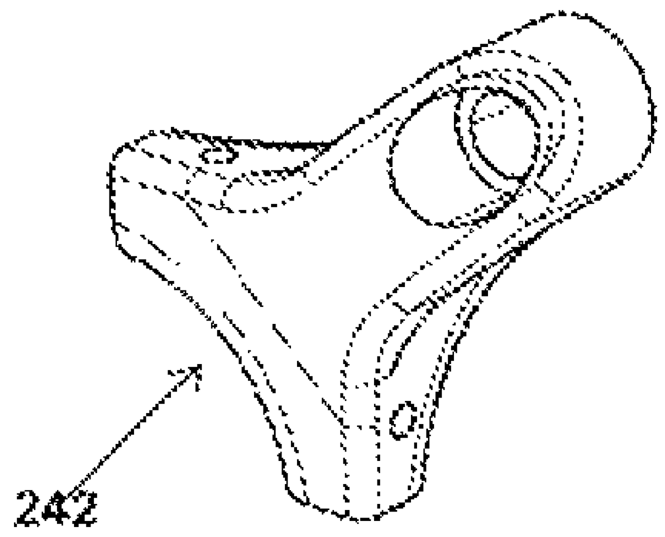

Figure 9b

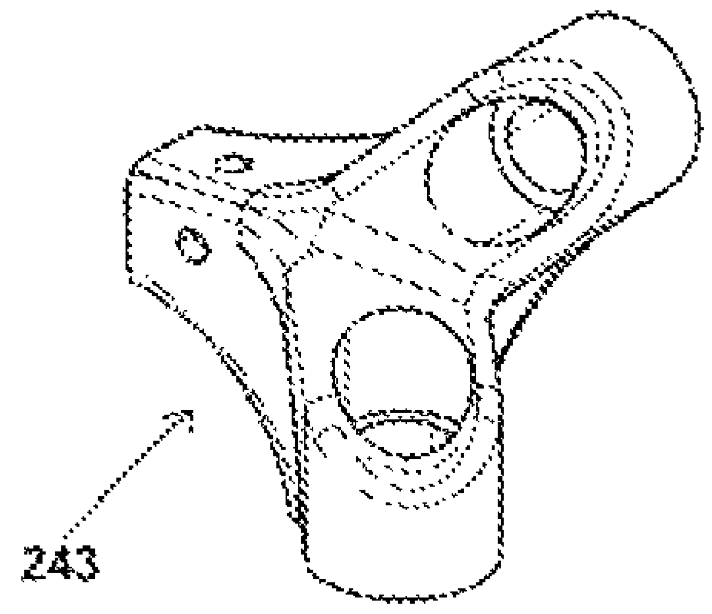

Figure 9c

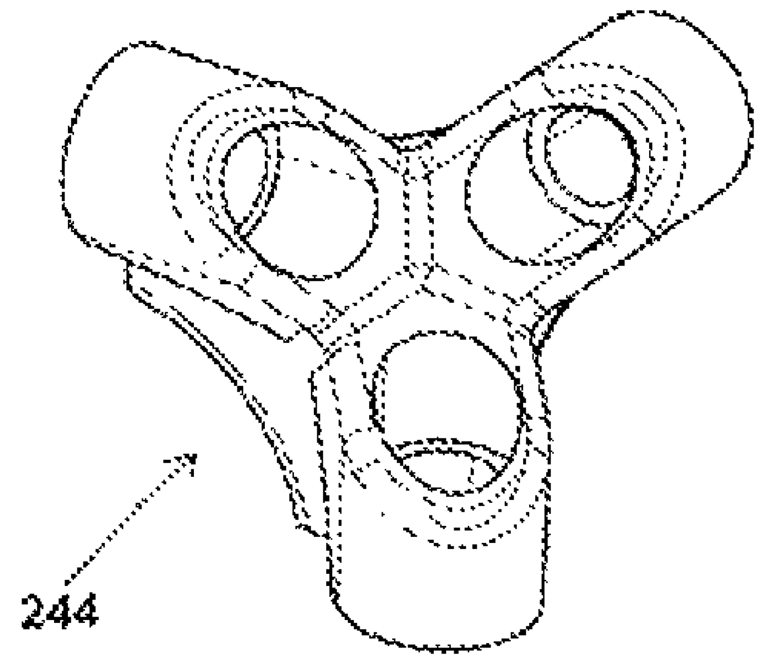

Figure 9d

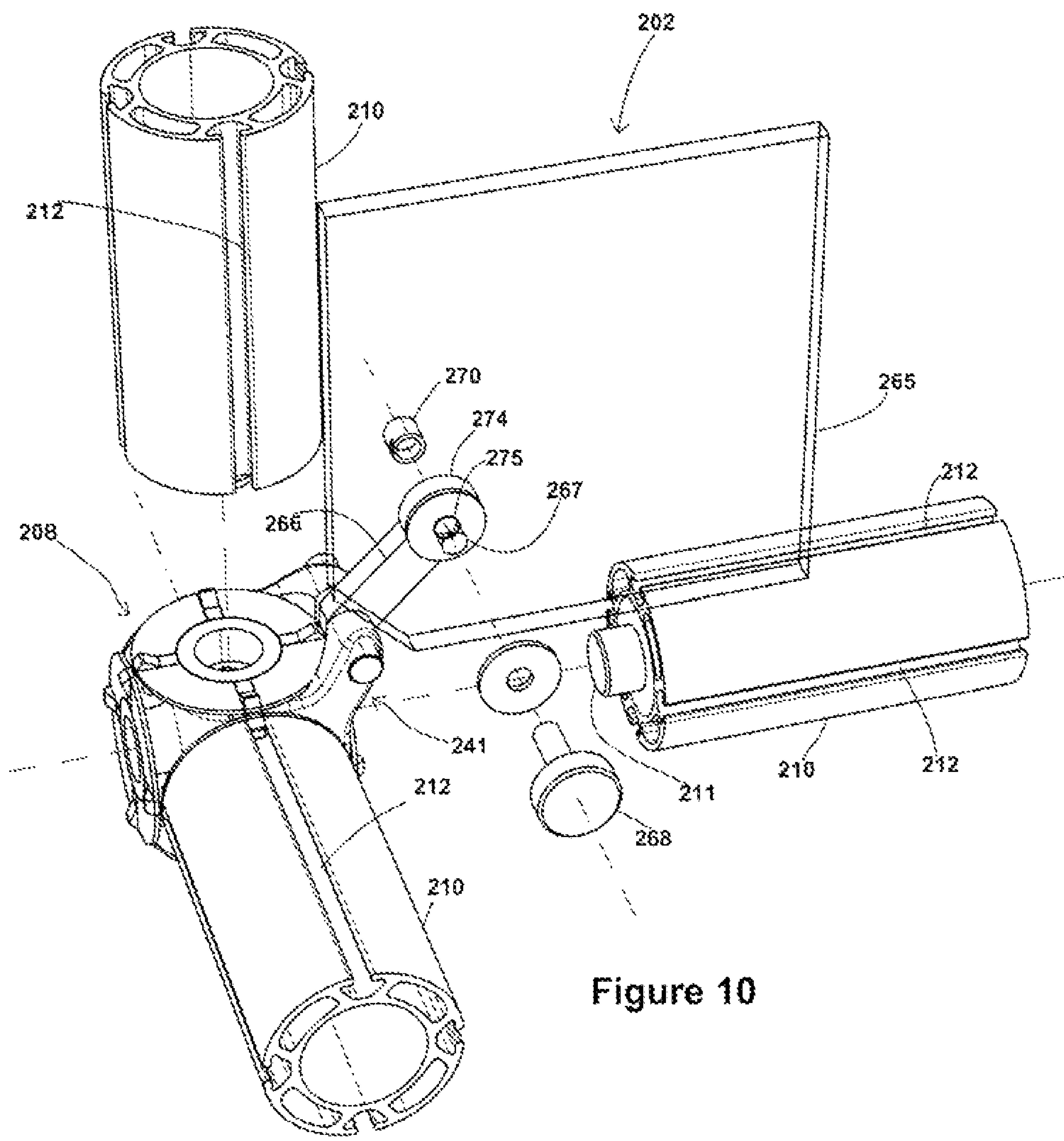
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Figure 10

SUPPORTING FRAMEWORK HAVING CONNECTION NODES

This is a divisional application of application Ser. No. 14/383,108 filed on Sep. 5, 2014 which relates to a supporting framework, having connection nodes, the connection nodes having connectors, bars, and framework components, including panels and diagonal braces.

BACKGROUND

Technical Field

That type of framework systems have been known for a long time, and used both in temporary and contemporary structures. The connectors connect bars to each other, producing connection nodes. In those framework systems, especially in temporary structures, like fair stands or booths, the connectors are preferably manufactured from a durable material, like stainless steel, that can withstand the load and weariness due to the numerous connection/disconnection routines, while the bars are preferred to be manufactured from lightweight and preferably extrudable materials, like aluminum, to benefit from customizable cross sections. Therefore, in most cases, the connectors are the preferred elements in the framework system that the framework components, including panels and especially diagonal braces, are connected to. The panels are flat elements, used mainly for separation purposes and diagonal braces comprise elongated elements in the form of a rod, wire or a profile element, used for improving the load bearing capacity of the framework system and bear compression or tension forces or both.

Because the connectors are used numerously in those framework systems, the excess weight of an oversized connector has a limiting effect on the load bearing capacity of the overall system. The oversized connectors have negative effects, also on manufacturing costs and on labor costs due to the increased time for setting the system numerously up and down especially in temporary structures, like fair stands or booths.

Connectors are generally polyhedron shaped elements with faces that receive bars. For reasons of not getting oversized and stabilization of the bars, the faces are shaped in relation with the cross section of the bar that is received, in such a way that, is covered by the bar substantially, if possible. The peripheral surface of the connector get covered substantially, when each of the faces receive at least one bar and especially in the cases of the bars with cross sections, shaped as a convex polygon, especially a regular convex polygon or a circle. That type of bars is among the most widely used types of bars in the framework systems, due to their high torsional resistance. The problem arises when to add framework components to their connectors. In known framework systems, the connectors fail to receive the framework components without being considered as oversized, especially for the cases in those systems, when those connectors are also used without the framework components, regarding that the components are used in the system only where needed. The additional faces, physical elements or surface area, dedicated for attaching the components, increase the overall size of those connectors and make them considered as over-sized. Furthermore, the over-sized connectors and their additional features dedicated for attaching components which usually remain useless for the cases without them, usually have negative effects on the ability of the framework's capability of attaching panels, by interfering with them and bringing out a problem of making undesirable arrangements especially at the corners of that panels.

Among those polyhedron shaped connectors of known systems, there are lightweight connectors with hollow forms that have advantageous shape on attaching framework components, as in the prior art document; WO 02/081837 A. With certain modifications, aiming to make use of the cavity inside the connector and to attach the framework components, that type of connectors can come out to be able to receive framework components without a disadvantage of over-sizing. Because of being composed of flat elements, they are relatively lighter than the connectors other than hollow formed ones, but most of them have significantly poor load bearing capacity, because of the relatively small contact surfaces between the flat elements. Another document; WO 0149950 A discloses another hollow formed connector, with relatively higher stability. But, however, that connector, together with the former one, has a limited capacity, when it comes to adding diagonal braces. Because, in the case of a diagonal brace, that is fixed to the plates and apply especially tensile forces thereto, the plates cannot withstand to the forces with a relatively high magnitude, without being ruptured. The option of increasing the thickness of the plates that those connectors are composed of, in most cases, gives away the other advantages of being hollow.

Most of the connectors other than hollow formed ones, generally don't have the disadvantage of poor loadability, but their problem is that, they attach the framework components, by means of certain modifications on the polyhedron shape, adding physical features, surface area or converting the polyhedron into another type of a polyhedron with additional faces to receive the framework components, when needed. So far, those solutions, failed to make their connectors to receive the framework components without getting oversized, especially for the cases with the same connectors in the system without that framework components. For example, in the prior art document, with the publication number US 2008/0175655 A, a cube shaped connector is suggested with a pair of extensions in the form of arms on a peripheral edge of each face of the connector, to form loops, wherein a diagonal connection with a hook-shaped end, is received and retained therein. But however, in order to locate the arms, the flat formed face elements are separated from each other and located at a distance at least the same as the length of the anus, increasing the overall size. The length of the anus must further be increased, for the cases the diagonal connection approaches to the surface of the bar, due to the angle therebetween, to prevent the end of the diagonal connection interfere with the surface of the bars. Furthermore, when a panel element with peripheral edges shaped in relation to the bars, is located in between a pair of bars, being surrounded thereby, the arms extend toward the panel element interfering therewith and brings a problem of making undesirable arrangements at the corners of that panels. That type of panel attachment is used frequently, especially in temporary framework systems like exhibition systems.

Therefore, the object of my invention is to produce a connection node, with a connector, connecting framework components and bars, especially bars with cross sections shaped circular or as a regular convex polygon, in a supporting framework system, substantially without being oversized, for both of the cases, the case with the framework components and the case, when those connectors are also used without the framework components.

SUMMARY

For the purpose I stated above and in accordance with the invention, I suggest a supporting framework, having nodes and at least one framework component. The framework components are either panels or diagonal braces or a combination of them. At least one node has a connector and at least one bar. At least one connector has a plurality of bar receiving members that are located in a corresponding plurality of faces of an imaginary polyhedron and at least one bar has a first end, fixed to the one of the bar receiving members of the connector of a first node and a second end, fixed to the corresponding bar receiving member of the connector of another node.

The supporting framework is characterized in that; the bar receiving members are in plate form and at least one connector further has an inner core, located in between the bar receiving members and the inner core has projections, each projecting toward one of the bar receiving members and connected to the back faces of them, the corresponding connector, further has at least one receiving plate, having a receiving member and each of the receiving plates is located between an adjacent couple of the projections of the inner core, and connected thereto, substantially, on an imaginary plane that passes through the longitudinal axes of each of the projections of the adjacent couple thereof, projecting toward the back faces of a corresponding adjacent couple of the bar receiving members and being connected thereto, whereby the receiving plates, the inner core and the bar receiving members, together, define a cavity, inside the imaginary polyhedron, at substantially at least one side of the receiving plate and the corresponding node further comprises at least one component holder having at least one supporting face and at least one projection and the component holder is located substantially in between the proximal portions of a first bar and a second bar, the second bar is adjacent to the first bar and the proximal portions of the bars are facing each other and the supporting face is located contacting with and substantially enclosing the proximal portion of at least of the one of the corresponding adjacent couple of the bars and the projection of the component holder projects inward the cavity, reaches the receiving member of at least one receiving plate and is releasably connected thereto and at least one framework component is connected to the component holder of the connector of at least two of the nodes, whereby a supporting framework is produced, wherein, the load of the framework components that is transferred to the node, is not taken and the stabilization of the framework components is not enabled, by the connector directly, but, shared between the connector and the surface of the bars. That collaboration decreases the share of the connector and the receiving plates, on load bearing and stabilizing the framework components **102**, in accordance with the component holder and its projection, and a component holder, substantially as described and in accordance with the invention, is used with a preferable connector, having disc shaped bar receiving members that are located substantially at a tangential position to others, in a corresponding plurality of faces of an imaginary cube, the connector receiving cylindrical bars, with diameters substantially the same as the imaginary cube edges. Thus, a connector is produced, which is not over-sized, yet having the ability of being connected to framework components in a supporting framework system.

For the purposes stated above and in accordance with the invention, I suggest another supporting framework, having nodes and at least one framework component. The framework components are either panels or diagonal braces or a combination of them. At least one node has a connector and at least one bar. At least one connector has a plurality of bar receiving members that are located in a corresponding plurality of faces of an imaginary polyhedron and at least one bar has a first end, fixed to one of the bar receiving members of the connector of a first node and a second end, fixed to the corresponding bar receiving member of the connector of another node.

The supporting framework is characterized in that; the bar receiving members are in plate form and at least one connector further has an inner core, located in between the bar receiving members and the inner core has projections, each projecting toward one of the bar receiving members and connected reversibly to the back faces of them, the corresponding connector, further has at least one receiving plate, having a receiving member and each of the receiving plates, is located between an adjacent couple of the projections of the inner core, and connected thereto, substantially, on an imaginary plane that passes through the longitudinal axes of each of the projections of the adjacent couple thereof, projecting toward the back faces of a corresponding adjacent couple of the bar receiving members and being connected thereto, whereby the receiving plates, the inner core and the bar receiving members, together, define a cavity, enlarging towards inside of the imaginary polyhedron, at substantially at least one side of the receiving plate, the corresponding node further comprises at least one holder, having a first portion located in the cavity, substantially in between at least three adjacent receiving plates and the holder is shaped such that, the first portion can be placed in the cavity with a removal of at least one of the corresponding bar receiving members and is retained therein when the bar receiving members are replaced, the first portion extends towards the receiving member of at least one receiving plate and is releasably connected thereto and a second portion of the holder extends outward the connector and at least one framework component is connected to the holder of the connector of at least two of the nodes. The movability of the bar receiving members enable the holder to use the cavity, inside the imaginary polyhedron, more effectively and to be able to be connected to a plurality of receiving plates when necessary. Thus, a framework node is produced wherein; the connector's capacity of attaching framework components, especially diagonal braces, is improved with regard to the capacity of a polyhedron shaped connector, of the same overall size and with faces immovable. In accordance with the invention, this improvement enables, a preferable connector, to be produced, having disc shaped bar receiving members that are located substantially at a tangential position to others, in a corresponding plurality of faces of an imaginary cube, receiving cylindrical bars, with diameters substantially the same as the imaginary cube edges, the connector, yet, having the ability of being connected to framework components.

Preferably at least one holder, further comprises at least one supporting face and the second portion of the holder, extends outward the cavity towards a location substantially in between a proximal portion of a couple of the adjacent bars, and the supporting face thereof, is located contacting with and enclosing the proximal portion of at least one of the corresponding couple of the adjacent bars, whereby the load of the framework components is transferred both, to the receiving plates and to the surface of the bars but not directly to the bar receiving members.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of the framework node, showing the connection of the component holder.

FIG. **2***a* is a side elevation of the connector, and FIG. **2***b* is a perspective view of the connector.

FIGS. **3***a* and **3***b* are perspective views of the framework node with the component holder. FIG. **3***a* illustrates the diagonal tension brace as framework components and FIG. **3***b* illustrates diagonal compression brace as framework components.

FIG. **4***a* is a perspective view of the connector and illustrates the connection of the component holder to the connector, FIGS. **4***b*, **4***c*, **4***d*, **4***e* and **4***f* illustrate different examples of the component holder.

FIG. **5** is a perspective view of the framework node, illustrating the panel connection to the node with a panel arm.

FIG. **6***a* is a perspective view of the modular connector, FIG. **6***b* is an exploded perspective view of the modular connector.

FIG. **7** is a perspective view of the framework node with the modular connector and illustrates the connection of the holder.

FIG. **8** is a perspective view of the modular connector and illustrates the connection of the holder.

FIG. **9***a* is a perspective view of the holder and FIGS. **9***b*, **9***c* and **9***d*, illustrate different examples of the holder.

FIG. **10** is a perspective view of the framework node, with the modular connector and the panel arm, illustrating the panel connection to the node with a panel arm.

DETAILED DESCRIPTION OF EMBODIMENTS

With reference to the embodiment shown in FIG. **1**, bars **110** are connected to the connector **108**, to produce a framework node **101**. The node **101** receives a framework component **102**. The framework component **102** can be a diagonal brace **103** or a panel **165** as shown in FIG. **5** that I will mention later. The diagonal brace **103** can be either a diagonal tension brace **104** or a diagonal compression brace **105**. The connector **108** has bar receiving members **113**. The bar receiving members **113** are shaped in relation to the cross section shape of the bars **110**. As shown in FIG. **1**, the bar receiving members **113**, are located in a corresponding plurality of faces of the imaginary polyhedron **119**. The imaginary polyhedron **119** is basically a cube, but it can be shaped as another type of a polyhedron. The bar receiving members **113**, are in plate form and preferably circular shaped, but it is also possible to shape the plates as convex polygons, like hexagon or octagon (not shown). The connector **108** has an inner core **120**. The inner core **120**, is located in between the bar receiving members **113**. The inner core **120**, has projections **122**, and each of these projections **122**, extend toward one of the bar receiving members **113** and connected to the back faces **114** of them. In cases when the imaginary polyhedron **119** is a cube, the inner core **120** has six projections **122**, each extending preferably perpendicular toward one of the six bar receiving members **113** and connected to the back faces **114** of them. The connector **108** also has receiving plates **124**. Those receiving plates **124** are located between the adjacent couples of the projections **122** and connected to them. The receiving plates **124** are located on an imaginary plane that passes through the longitudinal axes of the adjacent couple of the projections **122**, as shown in FIG. **2***b* and they extend toward the back faces **114** of the corresponding adjacent couple of the bar receiving members **113** and are connected to them. In the connector **108** with an imaginary polyhedron **119**, which is a cube, there are twelve receiving plates **124** as shown in FIG. **2***b*. Each of the receiving plates **124** is partly hidden visually behind the bar receiving members **113**, especially in the cases that the shape of the bar receiving members **113** are circular in relation with the cross section of the bars **110** and doesn't increase the overall size of the imaginary polyhedron **119**. In addition to its role on receiving the framework components **102**, the receiving plates **124** also stabilizes the connector **108** and improves the load bearing capacity of the connector **108** significantly and without impairing the aesthetical appearance of the connector **108**. Each receiving plate **124** has a receiving member **125**. Inside the imaginary polyhedron **119**, the receiving plates **124**, the inner core **120** and the bar receiving members **113**, together define a cavity **128** at preferably each side of each of the receiving plates **124**.

The node **101** further has at least one component holder **149** as shown in FIG. **1**. The component holder **149** is located substantially in between the proximal portions **158** of a first and a second bar **110** as shown in FIG. **1**. Here the bars **110** are adjacent to each other and their proximal portions **158** are facing each other. The component holder **149** has at least one supporting face **156** and at least one projection **157**. The supporting face **156**, when properly located, contacts thoroughly and encloses the proximal portion **158** of the bars **110** and the projection **157** projects inward the cavity **128**, reaches the receiving member **125** of at least one receiving plates **124** and is releasably connected thereto. At least one framework component **102** is connected to the component holder **149** of the connector **108** of at least two of the nodes **101**. Thus, a supporting framework is produced, wherein, the load of the framework components **102** that is transferred to the node **101**, is not taken and the stabilization of the framework components **102** is not enabled, by the connector **108** directly, but, shared between the connector **108** and the surface of the bars **110**. That collaboration decreases the share of the connector **108** and the receiving plates **124**, on load bearing and stabilizing the framework components **102** and in accordance with the projection **157**, and in accordance with the invention, a component holder **149**, substantially as described, can be used with a preferable connector **108**, having disc shaped bar receiving members **113** that are located substantially at a tangential position to others, in a corresponding plurality of faces of an imaginary cube, the connector receiving cylindrical bars **110**, with diameters substantially the same as the length of the edges of the imaginary cube. Thus, a connector **108** is produced, which is not over-sized, yet having the ability of being connected to framework components **102** in a supporting framework system.

FIG. **3***a* shows diagonal tension braces **104** connected to the connector **108** as framework components **102** and FIG. **3***b* shows diagonal compression braces **105** connected to the connector **108**. Diagonal compression braces **105** are the framework components **102** among others that most benefit from the concept of collaboration of the bars **110** with the connector **108** on bearing the load of the framework components **102**. Because, when loaded, the diagonal compression braces **105** is pressed toward the proximal portion **158** of the bars **110**, in a manner being urged to preserve their relative position to the bars **110** and transfer their load mainly on the bars **110** and significantly decreases the role of the receiving plates **124** and the projection **157** of the component holder **149**. The same is true to some extend, for the diagonal tension braces **104**. The share of the bars **110**, in the collaboration with the connector **108**, on bearing the load of the diagonal tension braces **104**, is inversely proportional to the magnitude of the angle between the bars **110** and the diagonal tension braces **104**. At relatively small angles like 10-15 degrees as frequently used in trusses, the component holder **149** can transfer a considerable amount of the load of the diagonal tension brace **104** to the surface of the bar **110** and press the diagonal tension braces **104** toward the proximal portion **158** of the bars **110**, in a manner urging to preserve their relative position to the bars **110**, decreasing the share of the connector **108** on bearing the load of the diagonal tension braces **104** and on stabilizing them. As a result, the projections **157** of the component holders **149** of the can be sized small enough to be used with circular shaped bar receiving members **113** that are located at a tangential position to others. The connectors **108** receiving cylindrical bars **110** are among the connectors that are most likely to be oversized to receive the framework components **102**. Because the cylindrical bars **110** cover the faces of the imaginary polyhedron of the connectors thoroughly, leaving no room for placing features to receive the framework components **102**. The connectors in known systems failed to solve that problem without over-sizing the connector. I solve that problem by means of the inventive framework node **101**, one of the embodiment examples of which is illustrated in FIG. **1**.

The component holder **149** can be produced in various different versions. The component holder **149** that is shown in FIG. **1** is a one piece version. FIG. **3***a, b* and **4***a, b, c* show the component holder A **150**, having a first body **161**, located at the one side of the receiving plate **124**, and a second body **162**, located at the other side of that receiving plate **124**. FIG. **4***d, e* and *f* shows the component holder A **150**, located at only one side of the receiving plate **124**. Dividing the component holder **149** results in easier connection and enables the location of at least one component holder for each adjacent couple of the bars **110**. The receiving member **125** of the receiving plate **124** is basically an eye **126**, but it can be produced in the form of another type of a fastener, in relation with the corresponding projection **157** of the component holder A **150**. In FIGS. **4***a* and **4***b*, the projection **157** of the component holder A **150**, comprise an eye **159**, aligned to the eye **126** of the corresponding receiving plate **124** and the component holder A **150**, is connected to the receiving plate **124** by means of the bolt **169** that is inserted through each of the respective eyes **126** and **159** and the nuts **170**. The diagonal brace **103** has a brace eye **107** at one end and the component holder A **150** has an eye **160**. The diagonal brace **103** is located in between the first body **161** and the second body **162** of the component holder A **150**, the brace eye **107** is aligned to the eye **160** of the component holder A **150** and the diagonal brace **103** is connected pivotally to the first body **161** and the second body **162** by means of the bolt **169** and the nut **170**. Other types of fastener can also be used like a pin and an external retaining ring (not shown). In FIG. **4***c* one of the component holders A **150**, has a mating protrusion **163**, that, when connected to the diagonal brace **103**, protrudes toward the eye **159**, received and retained by the eye **159**. That can result in faster connection. In the FIG. **4***f*, the component holder A **150** has another mating protrusion **163** aligned and received by the brace eye **107** and the mating protrusion **163** has a spring ball **164** as shown in FIG. **4***f*, that provides additional resistance for the mating protrusion **163**, against an undesired dislocation of the component holder A **150** especially in the cases that the component holder A **150**, located at only one side of the receiving plate **124**, as shown in FIG. **4***f*. That spring ball **164** is a known element, having a spring, and a ball, that is placed in a bore, the spring pushing the ball (not shown). The FIGS. **4***e* and *d* show different combinations of the connection of the component holder A **150**.

The FIG. **5** illustrates a panel **165** as a framework component **102**, connected to the component holder A **150**. The panel preferably has a panel eye **167** and can be connected directly to the component holder A **150** by means of a bolt **169**. However, the preferred connection is made by means of a panel arm **166** that is connected to the component holder A **150** as shown in the FIG. **5**. The panel arm **166** has an eye **175** at the distal end and the panel **165** has a panel eye **167**. The panel **165** is placed in a position that the panel eye **167** is aligned to the eye **175** of the panel arm **166** and the panel **165** is connected to the panel arm **166** by means of a panel tap **168**, that is inserted through the panel eye **167** and the eye **175** of the panel arm **166** and a nut **170**. The FIG. **5** also shows that the connector **108** comprise a mating bore **109**, on each of the bar receiving members **113**, extending radially inward each of the corresponding projection **122** of the inner core **120** and the bars **110** comprise a bar end **111** preferably at each end of them. The bar end **111** is a protrusion, sized in relation to the mating bore **109** and the bar ends **111** of each bar **110** are inserted into the mating bore **109** of the corresponding connector **108**. The FIG. **6***a, b* and FIG. **7** illustrate, in accordance with the invention, another framework node **201**. The connector **208** connects bars **210** to produce the framework node **201**. As shown in FIG. **7** the node **201** receives framework component **202**. The framework component **202** in the FIG. **7** is a diagonal tension brace **204**. The framework component **202** can be a diagonal brace or a panel **265** as shown in FIG. **10** that I will mention later. The diagonal brace **203** can is either a diagonal tension brace **204** or a diagonal compression brace **205**. The connector **208** has bar receiving members **213**. The bar receiving members **213** are shaped in relation to the cross section shape of the bars **210**. As shown in FIG. **6***a*, the bar receiving members **213**, are located in a corresponding plurality of faces of the imaginary polyhedron **219**. The imaginary polyhedron **219** is basically a cube, but it can be shaped as another type of a polyhedron. The bar receiving members **213**, are in plate form and preferably circular shaped, but it is also possible to shape the plates as convex polygons, like hexagon or octagon (not shown). The connector **208** has an inner core **220**. The inner core **220**, is located in between the bar receiving members **213**. The inner core **220**, has projections **222**, and each of these projections **222**, extend toward one of the bar receiving members **213** and connected reversibly to the back faces **214** of them. In cases when the imaginary polyhedron **219** is a cube, the inner core **220** has six projections **222**, each extending preferably perpendicular toward one of the six bar receiving members **213** and connected reversibly to the back faces **214** of them. The connector **208** also has receiving plates **224**. Those receiving plates **224** are located between the adjacent couples of the projections **222** and connected to them. The receiving plates **224** are located on an imaginary plane that passes through the longitudinal axes of the adjacent couple, as shown in FIG. **7** and they extend toward the back faces **214** of the corresponding adjacent couple of the bar receiving members **213** and being connected to them. In the connector **208** with an imaginary polyhedron **219**, which is a cube, there are twelve receiving plates **224** as shown in FIG. **6***b*. Each of the receiving plates **224** is partly hidden behind the bar receiving members **213**, especially in the cases that the shape of the bar receiving members **213** are circular due to the cross section of the bars **210** and doesn't increase the overall size of the imaginary polyhedron **219**. In addition to its role on receiving the framework components **202**, it also stabilizes the connector **208** and increases the load bearing capacity of the connector **208** significantly and without impairing the aesthetical appearance of the connector **208**. Each receiving plate **224** has a receiving member **225**. The receiving plates **224**, the inner core **220** and the bar receiving members **213**, together define a cavity **228**, enlarging towards inside, at preferably each side of each of the receiving plates **224**.

The node **201** further has at least one holder **241** as shown in FIG. **7**. The holder **241** is located in the cavity **228**, substantially in between at least three adjacent receiving plates **224**. The holder **241** is shaped such that, the first portion **245** can be placed in the cavity **228** with a removal of at least one corresponding bar receiving member **213** and is enclosed and retained therein when the bar receiving members **213** are replaced. The first portion **245** extends towards the receiving member **225** of at least one receiving plate **224** and is releasably connected thereto and the second portion **246** of the holder **241** extends outward the connector **208** as shown in FIG. **7** and FIG. **8**. At least one framework component **202** is connected to the holder **241** of the connector **208** of at least two of the nodes **201**. The movability of the bar receiving members **213** enable the holder **241** to use the cavity **228**, inside the imaginary polyhedron **219**, substantially and to be connected to a plurality of receiving plates **224** when necessary, whereby a connector **208** is produced with a capacity of attaching framework components **202**, especially diagonal braces **203**, that is improved with regard to that of a polyhedron shaped connector, of the same overall size and with faces immovable. In accordance with the invention, this improvement enables, a preferable connector **208**, to be produced, having disc shaped bar receiving members **213** that are located substantially at a tangential position to others, in a corresponding plurality of faces of an imaginary cube, receiving cylindrical bars **210**, with diameters substantially the same as the length of the edges of the imaginary cube, the connector **208**, yet, having the ability of being connected to framework components **202**.

Preferably, the holder **241**, further comprises at least one supporting face **256** as shown in the FIG. **8** and the second portion **246** of the holder **241**, extends outward the cavity **228** towards a location substantially in between a proximal portion **258** of a couple of the adjacent bars **210**, and the supporting face **256**, comes into a substantially contacts with and enclose the proximal portion **258** of at least one of the couples of the adjacent bars **210**, whereby the load of the framework components **202** is transferred both, to the receiving plates **224** and to the surface of the bars **210** but not directly to the bar receiving members **213**.

The bar receiving members **213** are connected to the inner core **220** by means of the plate connector **217**. The plate connector **217** has a mating bore **218** at the first end, extending radially toward a second end **274** and the projections **222** of the inner core **220**, comprise a mounting bore **221** at the distal end **223**, extending radially inward. The bar receiving members **213** comprise an opening **215**. The bar receiving members **213** are mounted on the distal end **223** of the respective projection **222** of the inner core **220** by means of the plate connector **217**, inserted through the openings **215** of the bar receiving members **213** into the corresponding mounting bores **221** of the projections **222** of the inner core **220**. The second end **274** of the plate connector **217**, can be shaped, such that a simple fastener can be inserted into the mating bore **218**, and easily fasten the plate connector **217**. The bars **210** comprise a bar end **211** preferably at each end of them. The bar end **211** is a protrusion, sized in relation to the mating bore **218** and the bar ends **211** of each bar **210** are inserted into the mating bore **218** of the corresponding connector **208**.

Each of the bar receiving members **213**, have preferably have passages **216**. In a preferred connector **208**, with the imaginary polyhedron **219** that is a cube, there are basically four passages **216**. Each of the passages **216** are superposed to one of the receiving plates **224** and each of the receiving plates **224** has a protrusion **227**, that protrudes toward the corresponding passage **216** and the protrusion **227** is received and retained therein, whereby any rotative motion of the bar receiving members **213**, with regard to the longitudinal axis of the corresponding bars **210**, is restrained. That restraining provides additional protection against an undesired dislocation of the bar receiving members **213**.

In another preferred embodiment the bars **210** comprise slots **212** on their periphery, extending along the longitudinal axis of the bars **210**. There are basically four slots **212** for each bar **210**. Each one of the slots **212** is superposed to one of the protrusions **227** of the receiving plates **224**, and the protrusion **227** of those receiving plates **224**, protrude through the corresponding passages **216** of the bar receiving member **213** toward the corresponding slots **212** of the bars **210**, the protrusions **227** are received and retained in the slots **212**, whereby the rotative motion of the bars **210** with regard to their longitudinal axis, is restrained. That restraining provides additional protection against an undesired dislocation of the bars **210** and gives further resistance against the torsional movement of the bars **210**, providing a positive effect on the load bearing capacity of the framework node **201**. By means of the receiving plates **224** and especially that, they have protrusions **227**, protruding through the passages **216** of the bar receiving members **213**, the supporting role of the bar receiving members **213** is minimized and that can enable us to produce the bar receiving members **213** relatively thin and even from different materials like aluminum or plastic.

Preferably, the framework components **202** like diagonal braces **203** are located in between a two adjacent holders **241** and connected to the second portions **246** of them as shown in FIG. **8**. However, any of those framework components **202** can be connected to one of the holders **241** and the second portions **246** of them can be shaped to orient to the position of the framework components **202**. The holder **241** can be adapted to be used with a plurality of framework components **202**. FIG. **9***b* shows one way holder **242**, adapted to be used with only one framework component **202**, FIG. **9***c* shows two way holder **243**, adapted to be used with two framework components **202** and FIG. **9***d* shows three way holder **244**, adapted to be used with three framework components **202**. As shown in the figures different types of diagonal braces **203** can be used in combination, without interfering the others.

As I mentioned before, a framework component **202** can either be a diagonal brace **203** or a panel **265**. Each of the diagonal braces **203** preferably has a brace eye **207** at one end and the second portion **246** of the holder **241** preferably has an eye **260**. The brace eye **207** is aligned to the eye **260** of the holder **241** and the diagonal brace **203** is connected pivotally to the second portion **246** of the holder **241** by means of a bolt **269** and a nut **270**. Other types of fasteners can also be used like a pin and an external retaining ring (not shown). The panel **265** can be connected directly to the holder **241**, but preferably the panels **265** are connected to the holder **241** by means of a panel arm **266**, that is connected to the holder **241** as shown in the FIG. **10**. The panel **265** preferably has a panel eye **267** and the panel arm **266** has an eye **275** at the distal end. The panel **265** is placed in a position that the panel eye **267** is aligned to the eye **275** of the panel arm **266** and the panel **265** is connected to the panel arm **266** by means of a panel tap **268**, that is inserted through the panel eye **267** and the eye **275** of the panel arm **266** and a nut **270**.

As shown in FIG. **9***a* the ends of the first portion **245** of the holder **241** comprise mounting bores **252**. The mounting bores **252** are aligned to the receiving member **225** of the receiving plates **224**. In this case the receiving member **225** of the receiving plate **224** is an eye **226**. However, it can be shaped as another fastener in relation to the first portion **245** of the holder **241**. The holder **241** is connected to the receiving plate **224** by means of a pin **1 253**, that is located in the mounting bore **252** and inserted into the eye **226** of the corresponding receiving plate **224**. In the case of the imaginary polyhedron **219** is a cube, the first portion **245** of the holder **241** is connected basically to three adjacent receiving plates

224, thus, comprise three mounting bores 252. However, that number can vary, depending on the shape of the first portion 245 and that number of the receiving plates 224 that the first portion is adapted to reach. As shown in FIG. 9a, the holder 241 comprises pinholes 255 on the first portion 245 to use with the pins 2 254. The pins 2 254 are used to adjust the position of the pins 1 253 inside the mounting bore 252 of the first portion 245 to enable locking and unlocking the connection.

INDUSTRIAL APPLICABILITY

All of the connectors and the connection elements can be produced with high quality stainless steel casting. Panel arms can be produced easily and economically with a conventional punch and bending process. The diagonal braces can be produced with conventional machining process. The bars can be made of aluminum and aluminum extrusion process can be used to produce the bars with custom cross sections, like bars with slots.

The invention claimed is:

1. A supporting framework, comprising:
a plurality of nodes; and
at least one framework component;
wherein the framework component is selected from a group, consisting of at least one diagonal brace, at least one panel and combinations thereof;
wherein at least one of the nodes comprises at least one connector and at least one bar;
wherein the at least one connector comprises a plurality of bar receiving members;
wherein the bar receiving members are located in a corresponding plurality of faces of an imaginary polyhedron;
wherein the bar having a first end is fixed to one of the bar receiving members of the connector of a first node;
wherein the bar having a second end is fixed to the corresponding bar receiving member of the connector of another node;
wherein the bar receiving members are in plate form;
wherein at least one of the corresponding connectors further comprises an inner core and at least one receiving plate;
wherein the inner core is located in between the bar receiving members;
wherein the inner core further comprises a plurality of projections,
wherein each of the projections projects toward one of the bar receiving members and connected to the back faces thereof;
wherein each of the receiving plates comprises a receiving member and is located between an adjacent couple of the projections of the inner core, and is connected thereto on an imaginary plane that passes through the longitudinal axes of each of the projections of the adjacent couple of the projections, extends toward the back faces of a corresponding adjacent couple of the bar receiving members and is connected thereto, whereby the receiving plates, the inner core and the bar receiving members together define a cavity;
wherein the cavity enlarges outwardly on at least one side of the receiving plate;
wherein at least one of the corresponding nodes further comprises at least one holder;
wherein a first portion of the holder is located in the cavity between at least three adjacent receiving plates;
wherein the holder is shaped such that the first portion can be placed in the cavity with a removal of at least one of the corresponding bar receiving members and is retained in the cavity when the bar receiving members are replaced;
wherein the first portion extends towards the receiving member of at least one receiving plate and is releasable connected thereto;
wherein a second portion of the holder extends outwardly towards the connector;
wherein the least one framework component is connected to the second portion of the holder of the connectors of at least two of the nodes.

2. The supporting framework of claim 1, wherein the bar receiving members are disc shaped and located at a tangential position to the adjacent bar receiving members.

3. The supporting framework of claim 1,
wherein the at least one holder further comprises at least one supporting face;
wherein the second portion of the holder extends outward the cavity towards a location in between a proximal portion of a couple of the adjacent bars;
wherein the supporting face is located substantially contacting with and enclosing the proximal portion of at least one of the couple of the adjacent bars.

4. The supporting framework of claim 1,
wherein the at least one connector further comprises a plate connector, and a a plurality of the inner cores;
wherein the plate connector comprises a mating bore at a first end and extends radially toward a second end;
wherein the projections of the inner core comprises a mounting bore at the distal end and extends radially inward;
wherein the bar receiving members comprise an opening and are mounted reversibly on the distal end of the respective projection of the inner core by means of the plate connector;
wherein the plate connector is inserted through the openings of the bar receiving members into the mounting bores of the projection of the inner core,
wherein an end of at least one bar is inserted into one of the mating bores.

5. The supporting framework of claims 1,
wherein the at least one bar receiving members comprises at least one passage;
wherein the passage is superposed to one of the receiving plates;
wherein the receiving plate comprises a protrusion that protrudes toward the passage thereof;
wherein the protrusion is received and retained therein, whereby the rotative motion of the bar receiving members, with regard to the longitudinal axis of the corresponding bars, is restrained.

6. The supporting framework of claim 5,
wherein the at least one bar comprises at least one slot on the periphery thereof and extends along the longitudinal axis of the bar;
wherein the slot is superposed to one of the protrusions of one of the receiving plates;
wherein the protrusion protrudes through the corresponding passage of the bar receiving member toward the slot of the bar;
wherein the protrusion is received and retained in the slot, whereby the rotative motion of the bars, with regard to the longitudinal axis of the corresponding bars, is restrained.

7. The supporting framework of claim **1**, wherein at least one framework component is located in between the second portions of an adjacent couple of holders and connected to the second portions thereof.

8. The supporting framework of claim **1**, wherein the second portion of the at least one holder is connected to a plurality of framework components.

9. The supporting framework of claim **1**, wherein the at least one framework component is a diagonal brace and is connected to the second portion of the at least one holder.

10. The supporting framework of claim **1**,

wherein the at least one framework component is a panel;

wherein the corresponding node comprises at least one panel arm, wherein a first end of the panel arm is connected to the second portion of the holder and a second end of the panel arm is connected to at least one panel.

11. The supporting framework of claim **1**, wherein the receiving member of the at least one receiving plate is an eye.

12. The supporting framework of claim **1**,

wherein at least one end of the first portion of the at least one holder comprises the mounting bore,

wherein the mounting bore aligns to the eye of the corresponding receiving plate and the holder is connected to the receiving plate by means of a pin;

wherein the pin is located in the mounting bore and inserted into the eye of the corresponding receiving plate.

13. The supporting framework of claim **1**, wherein the at least one bar is cylindrical.

14. The supporting framework of claim **1**, wherein the imaginary polyhedron of the at least one connector is a cube.

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